BEFORE
THE PUBLIC UTILITIES COMMISSION OF OHIO

In the Matter of the Application of Ohio	**:**	**Case No. 09-1820-EL-ATA**
Edison Company, The Cleveland Electric	**:**	**Case No. 09-1821-EL-GRD**
Illuminating Company, and The Toledo	**:**	**Case No. 09-1822-EL-EEC**
Edison Company for Approval of Ohio	**:**	**Case No. 09-1823-EL-AAM**
Site Deployment of the Smart Grid	**:**	
Modernization Initiative and Timely	**:**	
Recovery of Associated Costs	**:**	

REPORT

On May 28, 2015, the Commission issued a Finding and Order ("Order") granting Ohio Edison Company, The Cleveland Electric Illuminating Company and The Toledo Edison Company's (collectively, the "Companies") Application to complete studies related to the Ohio Site Deployment of the Smart Grid Program ("Smart Grid Pilot"). In that Order, the Commission ordered the Companies to file an interim report regarding the data obtained from the Volt Var Optimization and Distribution Automation studies annually. The Companies hereby submit their annual interim report for the 12-month period ending May 31, 2022.

Distribution Automation (DA)

For the 34 CEI pilot circuits with DA, the Companies analyzed the impact of DA on reliability metrics through May 31, 2022, excluding major storms, and separately analyzed major storm performance. Consistent with the tracking and reporting for the Companies' Grid Mod I project, the DA performance in the Smart Grid Pilot area was analyzed by comparing actual reliability with the smart grid investments to performance without the smart grid investments.

Non-Storm (DA)

Over the last 8 years, customers in the Smart Grid Pilot area have avoided over 82,000 power outages and saved nearly 16 million customer outage minutes. On average, over the last

8 years, the customers in the Smart Grid Pilot area have seen a 44-minute reduction in average annual outage duration, a 2-minute improvement over the previous reporting period.

Non-Storm Reliability Saved -- Smart Grid vs. Non Smart Grid (June 2014 thru May 2022)

					SG Circuit Savings	
	Customers Interrupted Savings	% Savings	CMI Savings	% Savings	SAIFI	SAIDI
Year One (Jun '14 thru May '15)	5,425	*11%*	783,922	*15%*	0.12	17.44
Year Two (June '15 thru May '16)	4,448	*6%*	883,757	*11%*	0.10	19.65
Year Three (June '16 thru May '17)	7,207	*10%*	1,384,650	*18%*	0.16	30.51
Year Four (June '17 thru May '18)	10,814	*14%*	1,841,098	*25%*	0.24	40.28
Year Five (June '18 thru May '19)	23,502	*22%*	3,315,636	*29%*	0.51	71.68
Year Six (June '19 thru May '20)	6,198	*10%*	1,689,989	*25%*	0.13	36.51
Year Seven (June '20 thru May '21)	12,634	*13%*	3,506,419	*31%*	0.28	76.36
Year Eight (June '21 thru May '22)	12,495	*15%*	2,584,275	*20%*	0.27	55.24
Grand Total	**82,723**	***13%***	**15,989,746**	***23%***	**0.23**	**43.66**

Notes

1. Outages include, Distribution, Substation, and Transmission, excludes major storms
2. Includes tap outages that would not have been affected by Smart Grid facilities

Storm (DA)

Over the last 8 years, during major storms customers in the Smart Grid Pilot area have avoided over 20,000 power outages, a reduction of 12%, and saved 8.4 million customer outage minutes, representing a 14% improvement. On average, the customers in the Smart Grid Pilot area have seen a 23-minute reduction in average annual outage duration during major storms.

Major Storm Reliability Saved -- Smart Grid vs. Non Smart Grid (June 2014 thru May 2022)

					SG Circuit Savings	
	Customers Interrupted Savings	% Savings	CMI Savings	% Savings	SAIFI	SAIDI
Year One (Jun '14 thru May '15)	3,469	*18%*	631,594	*11%*	0.08	14.06
Year Two (June '15 thru May '16)	0	*0%*	13,520	*1%*	0.00	0.30
Year Three (June '16 thru May '17)	2,440	*9%*	2,070,046	*21%*	0.05	45.61
Year Four (June '17 thru May '18)	1,899	*15%*	614,638	*8%*	0.04	13.45
Year Five (June '18 thru May '19)	4,075	*12%*	2,374,258	*24%*	0.09	51.33
Year Six (June '19 thru May '20)	4,693	*14%*	1,876,616	*15%*	0.10	40.54
Year Seven (June '20 thru May '21)	715	*3%*	535,963	*6%*	0.02	11.67
Year Eight (June '21 thru May '22)	3,147	*19%*	317,183	*6%*	0.07	6.78
Grand Total	**20,438**	***12%***	**8,433,818**	***14%***	**0.06**	**23.03**

Notes

1. Outages include, Distribution, Substation, and Transmission, includes major storms only
2. Includes tap outages that would not have been affected by Smart Grid facilities
3. Catastrophic events on 11-15-2020 and 12-1-2020 are excluded. Basis for this exclusion explained in the paper titled "Analysis of Catastrophic Events Using Statistical Outlier Method" published by IEEE.
4. Customer outages for major storms capped at 24 hours.

For purposes of this analysis, the Companies excluded events on November 15, 2020 and December 1, 2020. This is based on a methodology described in the paper entitled "Analysis of Catastrophic Events Using Statistical Outlier Method" published by IEEE. While the events on these days were major storms, they would also be considered catastrophic events that are outside the normal distribution of storm days for the five-year period. Therefore, these catastrophic events were excluded from the analysis as outliers.

Integrated Volt Var Control (IVVC)

During this reporting period (June 1, 2021 through May 31, 2022), the Companies continued to operate and monitor the performance of the IVVC equipment in the Smart Grid Pilot area. The Companies analyzed 7 core substations and 23 circuits deployed with IVVC during the 12-month period. During this reporting period, two primary operational modes for the IVVC were used:

1. Minimize Demand (MnDm): This operational setting is used to reduce customer usage and to minimize peak demand, both on a circuit and substation level. This setting will lower circuit voltages to the lower end of the allowable range and could impact power quality. The target voltage range for MnDm is 117 to 120 volts.
2. Maximize Power Quality (MxPQ): This operational setting is used to mitigate power quality issues that may be created following operational switching to restore customers or by one customer that impacts other customers on the circuit. This setting typically causes voltage to increase. The target voltage range for MxPQ is 123 to 125 volts.

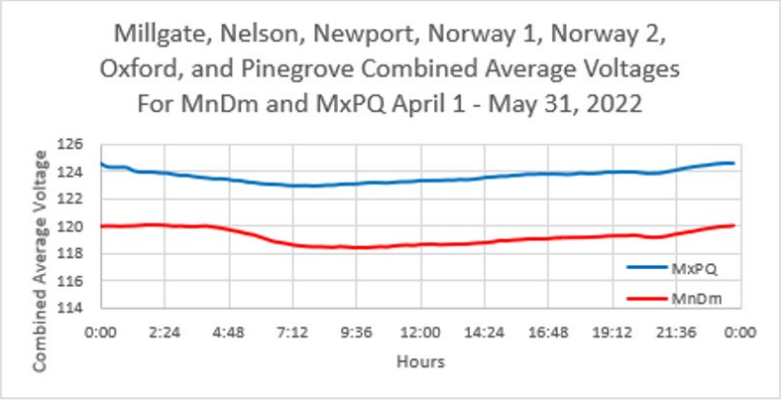
The Companies primarily let the IVVC system run in MnDm (CVR On) mode from June 2021 – March 2022 in the interest of providing energy savings benefits to the customers in the Smart Grid Pilot area. During April and May 2022, the modes were changed from MnDm to MxPQ on a cyclic, nearly daily basis to provide the data needed to analyze actual circuit factors, including energy use (kWh and %) reduction, and peak demand (kW and %) reduction from the IVVC system. The results from the spring 2022 analysis can be extrapolated to the full year and used to obtain a reasonably accurate estimate of annual circuit energy use (kWh and %) reduction for the reporting period.

The Companies evaluated operation of the IVVC system in two key performance areas, voltage separation and Conservation Voltage Reduction (CVR). The results of these evaluations are summarized below.

Voltage Separation

Voltage separation represents the system's ability to respond to operational commands to lower voltage. The greater the ability to intentionally lower distribution voltage while still maintaining compliance within the ANSI range, the greater the potential performance in terms of demand and energy consumption (i.e., Conservation Voltage Reduction or CVR).

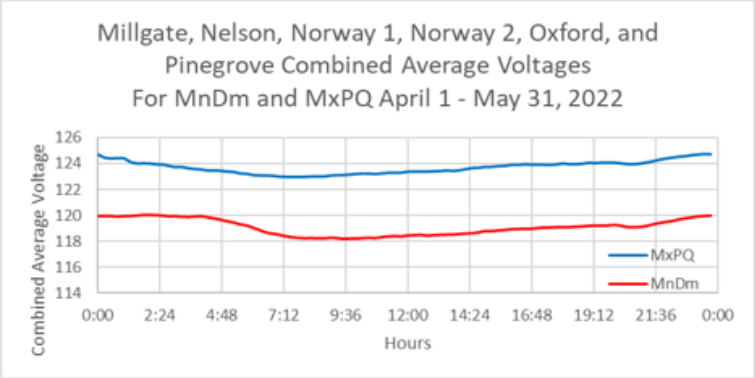
The graph below shows the combined average circuit phase voltage for the IVVC core substations, Millgate, Nelson, Newport, Norway 1, Norway 2, Oxford, and Pinegrove during the spring 2022 evaluation period (April 1 through May 31, 2022). The blue lines represent the average circuit phase voltage of the combined core substations when the operating mode was set to Maximize Power Quality (MxPQ). The red lines represent the average circuit phase voltage when the operating mode was set to Minimize Demand (MnDM). Overall, for all hours of operation during the study period, the average voltage separation between MxPQ and MnDm operating modes across these core substations was approximately 4.4 volts, a difference of 3.6%.



Average Voltage April 1 - May 31, 2022	
MxPQ	123.65
MnDm	119.23
Voltage Δ	4.43
%	3.58%

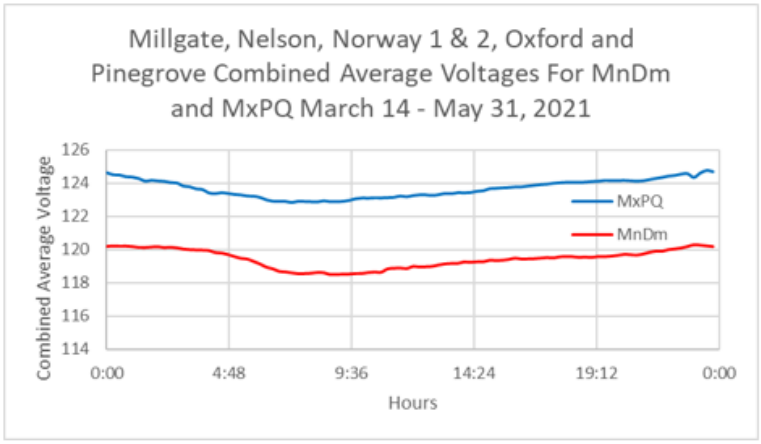
The next set of graphs compares the 2021 performance of the core substations and circuits to the 2022 performance of the core substations and circuits, excluding the Newport substation, because it was operating with a mobile substation in spring 2021. Results from spring 2022 show a slight improvement compared to last year. Average voltage for Minimize

Demand (MnDm) dropped from 119.41 volts to 119.11 volts for a reduction of 0.30 volts, while the voltage separation increased from 4.3 volts (3.47%) to 4.6 volts (3.74%).[1]



Average Voltage April 1 - May 31, 2022	
MxPQ	123.74
MnDm	119.11
Voltage Δ	4.63
%	3.74%

Average Voltage March 14 - May 31, 2021	
MxPQ	123.70
MnDm	119.41
Voltage Δ	4.29
%	3.47%



Conservation Voltage Reduction (CVR)

Conservation Voltage Reduction (CVR) is the long-term practice of controlling distribution voltage levels within the lower range of ANSI standard acceptable service entrance voltage levels in order to reduce demand and energy consumption.

[1] The spring 2021 results presented above are slightly different than those included in the similar table in last year's report. This is because the similar table in the 2021 report excluded Norway 1 and Norway 2, as those results were reported in the section entitled "Varentec Performance Evaluation." For this year's reporting, the 2021 results for Norway 1 and Norway 2 are included above.

The following tables show the results of the CVR analysis for the Millgate, Nelson, Newport, Norway 1, Norway 2, Oxford, and Pinegrove core substations by circuit, by substation and in the aggregate for the period April 1 through May 31, 2022. Overall, the average voltage reduction of approximately 4.4 volts from the voltage separation discussed above led to kWh savings of approximately 2.6%, while maintaining voltage well within the expected range.

Core Substation Circuit CVR Analysis: April 1 - May31, 2022														
Substation / Circuit	Temp Avg (Degrees F)		Operating Mode Days		Average Voltage (Volts)		Average Real Load to Voltage Ratio	Weighted Average Real LtVR (CVRf)	Voltage Reduction (Volts)	Voltage Reduction (Per Unit)	Average kWh/day Reduction	Average kWh Savings %	2 hr Peak kW Reduction %	4 hr Peak kW Reduction %
	CVR On	CVR Off	CVR On	CVR Off	CVR On	CVR Off								
Millgate L01	48.8	45.6	14.1	11.7	118.4	123.2	1.78	1.74	4.79	0.0399	2,486	6.8%	7.9%	7.7%
Millgate L02														
Millgate L03	47.9	-	0.1	-	118.3									
Millgate L04	48.8	45.5	14.1	11.7	118.1	123.0	1.12	1.12	4.85	0.0404	3,857	4.5%	9.0%	8.2%
MG Roll-Up	**48.8**	**45.5**	**7.1**	**5.9**	**118.2**	**123.1**	**1.32**	**1.30**	**4.82**	**0.0402**	**6,343**	**5.2%**	**9.0%**	**8.2%**
Nelson L01	55.1	51.4	19.8	21.0	118.2	123.7	1.01	0.96	5.59	0.0466	3,070	4.4%	10.6%	10.1%
Nelson L02	55.1	51.5	19.8	21.1	120.0	125.5	0.58	0.52	5.41	0.0451	1,106	2.3%	6.6%	7.3%
Nelson L03	55.1	51.5	19.8	21.0	118.4	124.1	0.52	0.42	5.62	0.0469	840	1.9%	3.2%	3.3%
Nelson L04	57.1	55.2	16.2	11.1	119.9	125.3	0.20	0.12	5.38	0.0448	219	0.4%	-3.4%	-4.3%
NL Roll-Up	**55.6**	**52.0**	**18.9**	**18.5**	**119.1**	**124.6**	**0.62**	**0.53**	**5.50**	**0.0458**	**5,236**	**2.4%**	**7.6%**	**7.5%**
Newport L01	53.4	53.0	21.5	19.4	119.9	122.6	0.41	0.37	2.66	0.0222	424	0.8%	0.3%	0.2%
Newport L02	53.4	52.6	21.5	18.4	120.2	123.8	0.68	0.63	3.61	0.0300	572	1.8%	0.5%	0.6%
Newport L03	53.4	53.0	21.5	19.2	120.0	123.7	0.77	0.74	3.62	0.0302	1,022	2.2%	2.2%	1.8%
Newport L04	53.4	53.0	21.5	19.4	119.9	122.6	0.41	0.37	2.66	0.0222	424	0.8%	0.3%	0.2%
Newport L05	53.5	52.9	20.1	16.6	119.5	123.1	1.18	1.17	3.54	0.0295	955	3.5%	0.3%	0.2%
NP Roll-Up	**53.4**	**52.9**	**26.5**	**23.2**	**119.9**	**123.1**	**0.63**	**0.60**	**3.22**	**0.0268**	**3,396**	**1.6%**	**1.0%**	**0.9%**
Norway L01	54.3	54.2	21.1	17.0	117.4	121.8	(0.29)	(0.23)	4.39	0.0366	(592)	-0.7%	-0.1%	-0.1%
Norway L02	54.3	54.2	21.1	17.0	120.2	124.7	0.35	0.36	4.56	0.0380	959	1.4%	2.0%	2.0%
NW 71 Roll-Up	**54.3**	**54.2**	**21.1**	**17.0**	**118.8**	**123.3**	**0.00**	**0.07**	**4.48**	**0.0373**	**367**	**0.2%**	**-0.4%**	**-0.3%**
Norway L03														
Norway L04	53.4	55.1	21.1	16.8	119.3	122.7	0.62	0.59	3.39	0.0283	1,275	1.6%	1.9%	2.1%
NW 72 Roll-Up	**53.4**	**55.1**	**21.1**	**16.8**	**119.3**	**122.7**	**0.62**	**0.59**	**3.39**	**0.0283**	**1,275**	**1.6%**	**1.9%**	**2.1%**
Oxford L01	54.5	51.5	20.7	19.9	120.6	124.9	0.23	0.22	4.37	0.0364	809	0.8%	1.8%	1.4%
Oxford L02	54.5	51.5	20.6	19.9	119.7	124.8	2.87	2.91	5.11	0.0426	8,028	12.8%	7.7%	8.2%
OX Roll-Up	**54.5**	**51.5**	**20.7**	**19.9**	**120.1**	**124.9**	**1.24**	**1.36**	**4.74**	**0.0395**	**8,837**	**5.4%**	**4.5%**	**4.8%**
Pinegrove L01	52.7	53.8	20.7	20.2	118.6	123.5	0.27	0.25	4.88	0.04	682	1.1%	0.2%	0.6%
Pinegrove L02	52.7	53.8	20.7	20.2	119.0	124.0	0.53	0.52	5.01	0.04	2,072	2.2%	2.6%	2.9%
Pinegrove L03	52.7	53.8	20.7	20.2	119.0	124.0	0.53	0.52	5.01	0.04	2,072	2.2%	2.6%	2.9%
Pinegrove L04	52.7	53.8	20.7	20.2	119.4	124.3	0.68	0.67	4.86	0.04	1,579	2.7%	-0.4%	-0.2%
PG Roll-Up	**52.7**	**53.8**	**20.7**	**20.2**	**119.0**	**123.8**	**0.50**	**0.57**	**4.83**	**0.04**	**7,192**	**2.3%**	**2.2%**	**2.1%**
Project Roll-Up	**53.4**	**52.5**	**20.4**	**18.2**	**119.2**	**123.7**	**0.76**	**0.77**	**4.43**	**0.04**	**32,647**	**2.6%**	**3.2%**	**3.3%**

Core Substation Circuit CVR Analysis: April 1 - May31, 2022														
Substation / Circuit	Temp Avg (Degrees F)		Operating Mode Days		Average Voltage (Volts)		Average Real Load to Voltage	Weighted Average Real LtVR	Voltage Reduction (Volts)	Voltage Reduction (Per Unit)	Average kWh/day Reduction	Average kWh Savings %	2 hr Peak kW Reduction	4 hr Peak kW Reduction
	CVR On	CVR Off	CVR On	CVR Off	CVR On	CVR Off								
MG Roll-Up	48.8	45.5	7.1	5.9	118.2	123.1	1.32	1.30	4.82	0.04	6,343	5.2%	9.0%	8.2%
NL Roll-Up	55.6	52.0	18.9	18.5	119.1	124.6	0.62	0.53	5.50	0.05	5,236	2.4%	7.6%	7.5%
NP Roll-Up	53.4	52.9	26.5	23.2	119.9	123.1	0.63	0.60	3.22	0.03	3,396	1.6%	1.0%	0.9%
NW 71 Roll-Up	54.3	54.2	21.1	17.0	118.8	123.3	0.00	0.07	4.48	0.04	367	0.2%	-0.4%	-0.3%
NW 72 Roll-Up	53.4	55.1	21.1	16.8	119.3	122.7	0.62	0.59	3.39	0.03	1,275	1.6%	1.9%	2.1%
OX Roll-Up	54.5	51.5	20.7	19.9	120.1	124.9	1.24	1.36	4.74	0.04	8,837	5.4%	4.5%	4.8%
PG Roll-Up	52.7	53.8	20.7	20.2	119.0	123.8	0.50	0.57	4.83	0.04	7,192	2.3%	2.2%	2.1%
Project Roll-Up	**53.4**	**52.5**	**20.4**	**18.2**	**119.2**	**123.7**	**0.76**	**0.77**	**4.43**	**0.04**	**32,647**	**2.6%**	**3.2%**	**3.3%**

Summary

The investments in the Smart Grid Pilot area have produced solid results and benefits for customers. The Companies continue to explore ways to further enhance both the software and the reliability and power quality performance of field devices. This includes increasing the application of single-phase trip, where possible, to lower the number of customer interruptions caused by single-phase faults, working with the Companies' DA/IVVC vendor to customize software to receive better system performance, and leveraging worst performing circuit mitigation to improve the performance of the 34 circuits with DA and IVVC, where applicable.

In 8 years of operation in the Smart Grid Pilot area, the Companies have gained significant knowledge and lessons learned on how DA and IVVC can be deployed to benefit customers. The Companies have identified improvements to construction practices and analytics which include, but are not limited to, grounding improvements with smart devices, device control settings, conducting real time analysis of circuits to gain better CVR, and implementing DA and IVVC along with associated software systems together in an integrated fashion to drive benefits for customers.

The Companies will continue analyzing the performance of the DA and IVVC investments in the Smart Grid Pilot area.

Respectfully submitted,

/s/ Christine E. Watchorn

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CERTIFICATE OF SERVICE

I hereby certify that the foregoing Report was filed electronically through the Docketing Information System of the Public Utilities Commission of Ohio on this 14th day of September 2022. The PUCO's e-filing system will electronically serve notice of the filing of this document on counsel for all parties, and the undersigned has served electronic copies to the following parties:

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Attorney for Ohio Edison Company, The Cleveland Electric Illuminating Company, and The Toledo Edison Company

Summary: Report Interim Report for 12-Month Period Ending May 31, 2022 on Volt Var Optimization and Distribution Automation Studies electronically filed by Ms. Christine E. Watchorn on behalf of Ohio Edison Company and The Cleveland Electric Illuminating Company and The Toledo Edison Company